The Distribution of Dryopteris spinulosa and its Relatives in Eastern Canada

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There are some excellent distribution maps of vascular plants from Quebec and Labrador in Rousseau (1974). However, his map for *Dryopteris spinulosa* (O. F. Muell.) Watt actually groups data for all the species of *Dryopteris* which have been referred to as the *D. spinulosa* complex, much as Boivin (1966) did when considering *D. austriaca* (Jacq.) Woynar. This conceals the interesting geographic patterns found in eastern North America, where there are three northern limits in Quebec and Labrador and one southern limit. Biosystematists (Wagner, 1971; Wherry, 1961) recognize two diploid species and two tetraploid species in this complex. The diploids are *D. intermedia* (Muhl.) A. Gray and *D. assimilis* S. Walker (which also has been called diploid *D. dilatata* or diploid *D. spinulosa* var. *americana)*. The tetraploids are *D. spinulosa* (O. F. Muell.) Watt (sometimes called *D. carthusiana* (Villar) H. P. Fuchs) and *D. campyloptera* Clarkson.

After determining that the northern Clay Belt plants near Amos were in fact diploid and not tetraploid *D. campyloptera* as expected (Britton, 1967), I decided in the tradition of Wherry to attempt to delineate the ranges of the *D. spinulosa* complex species in Quebec, and more specifically to see if the ranges of the diploid *D. assimilis* and the tetraploid *D. campyloptera* overlapped. For studies of genomic analysis and chromatography, a concerted effort was made to find hybrids between these four species of the complex, which were found growing together at Métis and Mt. Albert in 1968. *Dryopteris assimilis* was looked for unsuccessfully in Prince Edward Island, Nova Scotia, and New Brunswick in 1970. In 1971 *D. campyloptera* was studied in Vermont and north in the Laurentians to St. Donat de Montcalm and Mt. Tremblant. In 1972 I collected material north of Quebec City and along the north shore of the St. Lawrence River to Sept Iles and from there to Labrador City. The cytological vouchers, which represent over 200 different plants, have supplied material for chemotaxonomic studies (Widén & Britton, 1971; Britton & Widén, 1974; Widén et al., 1975), and are a sample from which extrapolations can be made to similar phenotypes for the purpose of mapping. The maps in this paper have been prepared from selected specimens seen in the following herbaria: GH, MTMG, MT, MTJB, QFA, QUE, QMP, SFS, ULF.

Dryopteris intermedia.—There are scattered collections of this species (*Fig. 1*) from the boreal forest, but it is much more abundant in the mixed forests (maple-beech) in southwestern Quebec. One station with cytological specimens is near Amos (ca. 48° 30′ N), which is near the northern limit of its range (ca. 50° N). Only four stations are plotted north of this latitutde. Ferns with a similar distribution mapped by Rousseau (1974) with their respective map numbers are: *Osmunda cinnamomea* 28, *Osmunda regalis* 30, *Dryopteris cristata* 46, and *Pteridium aquilinum* 67.

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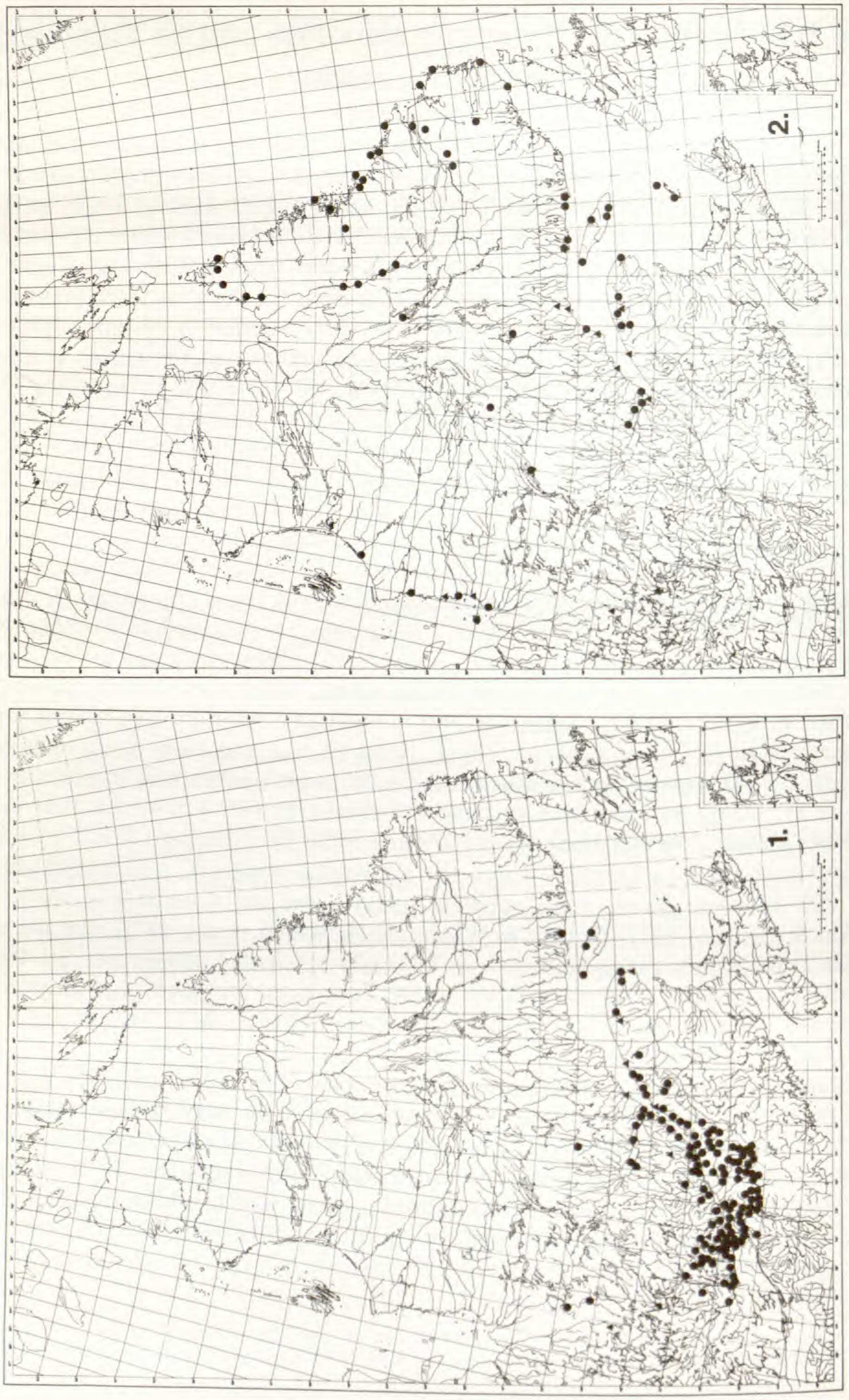


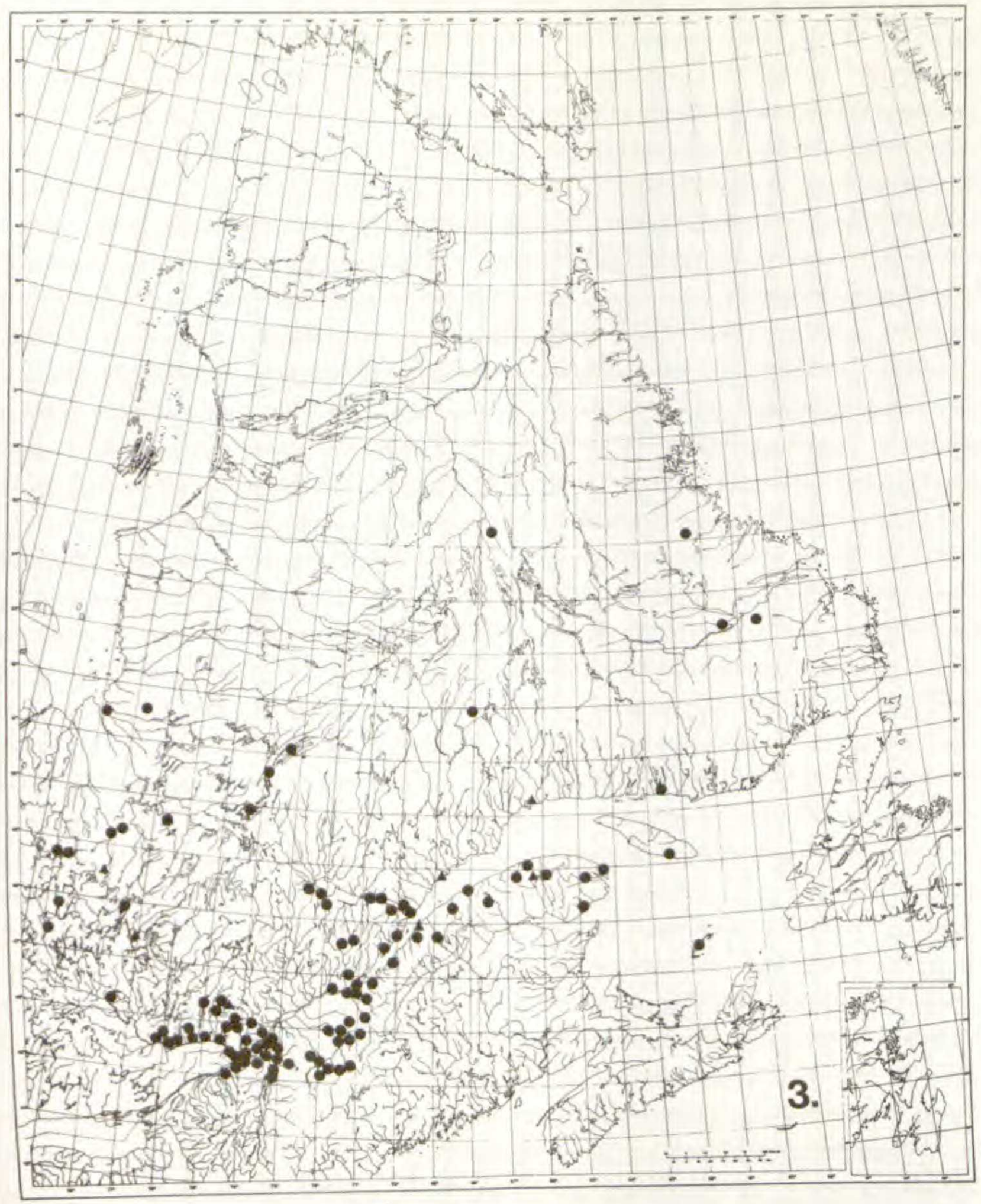
Distribution of *Dryopteris* in Quebec and Labrador. FIG. 1. *D. intermedia*. FIG. 2. *D. assimilis*. ▲ = collections cytologically determined.

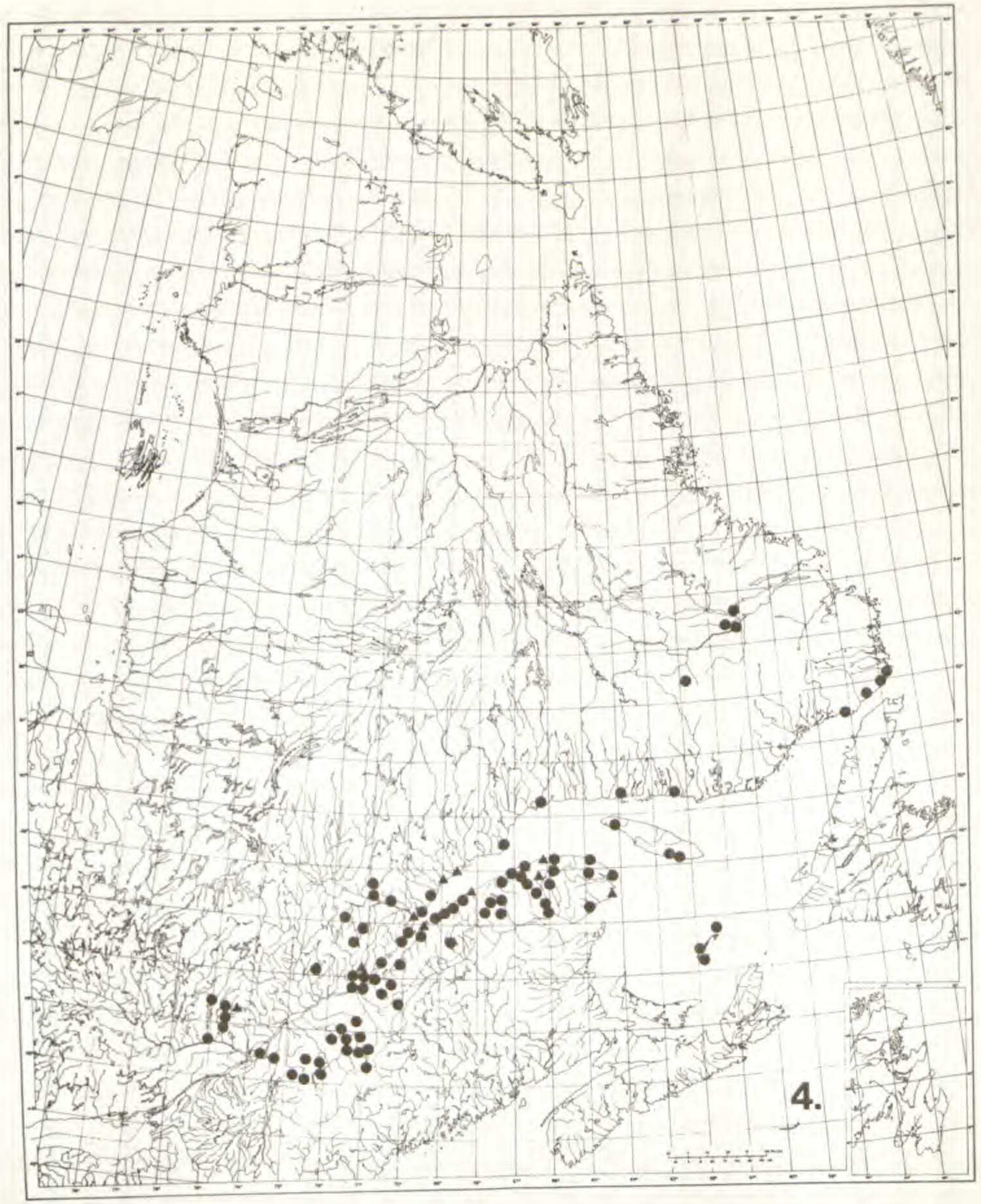
Dryopteris assimilis.—This species *(Fig. 2)* is a northern plant of cool, moist locations. It is well known in Iceland and Greenland and it is the only species of *Dryopteris* found in northern Labrador and Ungava. The known southern limit in Quebec is in La Verendrye Park near Dorval in the west and at the mouth of the Saguenay River, Méits, and Mt. Albert in eastern Quebec. A question that is unanswered at present in whether this species may become an arctic-alpine or sub-alpine in southern Quebec and New England. We have no cytological vouchers from such stations. Although it is unreported from Newfoundland, specimens from the north at St. Anthony would appear to be this species. None of the pteridophytes in Rousseau (1974) have quite the same pattern of distribution, although *Lycopodium alpinum* 6, *Woodsia alpina* 68, and *Woodsia glabella* 69 have some similarities.

Dryopteris spinulosa.—This species (*Fig. 3*) appears to grow in a few favorable locations up to 56° N, although cytological specimens have not been studied north of Amos and Guyenne at ca. 48° 30′ N. There are only four localities plotted from north of 52°, and further study may show that these represent poorly developed plants of *D. assimilis*. There are not as many collections of this species as one might expect. Collectors seem to have favored what they considered to be the more uncommon *D. assimilis, D. intermedia* and *D. campyloptera*. The distribution patterns most similar to this appear to *Botrychium virginianum* 26, *Onoclea sensibilis* 59 and *Polypodium virginianum* 62, as published by Rousseau (1974).

Dryopteris campyloptera.—This Appalachian species (*Fig. 4*) reaches its northern limit in western Quebec at Mt. Tremblant. It is still very abundant at St. Donat de Montcalm, Lac de l'Orignal in comté Terrebonne, Laurentides Parc north of Quebec City, to Forrestville, Percé in the Gaspé, Prince Edward Island, Cape Breton in Nova Scotia, etc. In other words, it is in the Laurentian Highlands. It is not expected above 47°N in the west or 52°N in the east, although it may occur sporadically along the north shore of the Gulf of St. Lawrence and on Anticosti Island. The species is well known from Newfoundland, but those specimens from north of 51°N are probably *D. assimilis*. Some specimens from around Goose Bay Labrador have been included here, but without cytological verification. When one travels along the north shore of the St. Lawrence, *D. campyloptera* is found at the mouth of the Saguenay intermixed with *D. assimilis*, both species are at Islets à Jeremie, but only *D. assimilis* can be found at Islets à Caribou and Sept Iles. The fern in Rousseau (1974) that has the most similar distribution is *Polystichum braunii* 64, which is a species that is often associated with *D. campyloptera* in rich, moist, deciduous woods.

The origin of Dryopteris campyloptera.—Widén and Britton (1971) suggested that *D. campyloptera* might be an autotetraploid of *D. assimilis* contra to the views of Wagner (1963, 1971). This decision was based on the following evidence: (1) Chromatographic results did not support the suggestion that present day *D. intermedia* was one parent of *D. campyloptera;* (2) A great majority of the specimens studied of *D. campyloptera* were glabrous, whereas hydrids with *D. intermedia* are known to have glandular indusia and midribs; (3) Early genome analysis by Walker (1961) suggested that *D. intermedia* was conspecific with *D. maderen-*





Distribution of *Dryopteris* in Quebec and Labrador. FIG. 3. *D. spinulosa*. FIG. 4. *D. campyloptera*. ▲ = collections cytologically determined.

sis and the latter species had the same ancestral genomes as *D. assimilis;* and (4) The analysis of pairing in hybrids of *D. assimilis* × *campyloptera* showed more than 41 pairs (46–49) of homologous chromosomes.

We now have the geographic evidence to consider. *Dryopteris assimilis* is a northern species and the derived *D. campyloptera* has a northern limit not unlike that of *D. intermedia*. There is very little overlap between *D. assimilis* and *D. campyloptera*. This evidence favors the view that *D. campyloptera* is indeed a derived allotetraploid of *D. intermedia* and *D. assimilis*. Wagner (pers. comm.) has pointed out that studies on spore sizes (Britton, 1968) also suggest that one parent of *D. campyloptera* should have small spores, e.g., *D. intermedia*, since *D. assimilis* and *D. campyloptera* have overlapping ranges of spore sizes. In the northern part of the range of *D. campyloptera* there are great difficulties in separating this species from *D. assimilis* unless one has cytological as well as morphological evidence. Also, the two species hybridize with each other more readily than with any other *Dryopteris* species. Their phenotypic similarity suggests that their genotypes must be very similar. In order to separate *D. campyloptera* from *D. assimilis*, one must find the very small contribution in *D. campyloptera* from a parent such as *D. intermedia*: more finely cut leaf, some evidence of firmer leaf texture and subevergreen leaves, some darker stipe scales, some influence on the shape of the basal pinnae, a more upright form, etc. These are all characters which are difficult to quantify and equally difficult to reduce to a simple, reliable key.

Dryopteris assimilis in Ontario.—The only major additions to the distribution map for *D. assimilis* (as *D. dilatata*) given by Britton and Soper (1966) are Reznicek's collection at Moosonee and Riley's collection in the Cochrane District at the latitude of Amos in Quebec. These two collections are connecting links with the collections of *D. assimilis* on the eastern side of James Bay (*Fig. 2*), and remove this species from one found only in the Lake Superior basin of Ontario.

In 1934, Dr. Wherry collected a specimen (TRT Acc. No. 118558) from Beaver Pond in Algonquin Park. He kindly gave me the exact location for this collection, which he said was unfortunately near the edge of the lake where there would be a good deal of ice movement in the spring. Several prolonged searches in the immediate area of this collection have failed to produce any living plants for cytology. Algonquin Park is noted for the presence of plants such as *Saxifraga aizoon* and *Lycopodium selago* with northern affinities, as well as plants such as *Picea rubens* with Appalachian affinities. Accordingly, this collection of Dr. Wherry could belong to either *D. assimilis* or *D. campyloptera*; however, its location in the more mesic hardwoods would suggest that it be referred to *D. campyloptera*, in which case it is our only specimen for this species in Ontario!

Hybrids.—The only common hybrid in this group is *Dryopteris* × *triploidea* Wherry (*D. intermedia* × *spinulosa*). One can usually find this hybrid wherever *D. intermedia* and *D. spinulosa* grow together. A distribution map for this species should be very similar to that for *D. intermedia* (*Fig. 1*). The only other hybrid involving just these four species of the *Dryopteris spinulosa* complex that has been collected in Quebec is *D. assimilis* × *campyloptera*, from near Mt. Albert

(Widén & Britton, 1971). It should be stressed that the morphological variation that one finds in these four species can *not* be attributed to the occurrence of hybrids. A concerted effort was made to find hybrids of *D. intermedia* × *campyloptera*, *D. campyloptera* × *spinulosa*, *D. assimilis* × *intermedia* and *D. assimilis* × *spinulosa*, and none were found. They must be of rare occurrence (Widén et al., 1975).

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